REMARKS

Independent claim 1 has been allowed. Claims 2, 3, and 27 were also allowed in the previous office action. Claim 2 has been amended according to the Examiner's suggestion. Claim 3 has been amended to correct a grammatical error (removal "into"). Claims 2-26 and 28-35 have been amended. The application now includes claims 1-35

The specification has been amended to correct grammatical and typographical errors, and to add explanatory information for clarity. No new matter has been introduced by this amendment.

The issues remaining in the office action appear to be related to claim language. In particular, claims 4-26, and 28-35 have been rejected under 35 U.S.C. 112, first and second paragraph. In addition, the figures have been objected to under 37 C.F.R. 1.83. These rejections and objections are traversed based on the amendments above, the proposed amendments to the drawings (attached), and the comments below. Below, each claim is addressed specifically, particularly as per the question raised by the Examiner in the office action, and the support in the specification, and drawings (amended or unamended), is identified. It appears that a major part of the issues raised by the Examiner stem from the use of "means for" language, when, in fact, elements previously recited in the claim perform the function. As will be clear from the amendments, many of the issues raised by the Examiner are effectively addressed by using "wherein" to further define features of the invention which are previously recited. The attached drawings are substantially the same as those presented with the previous amendment, except that the numeral identifier 10 has been added to many of the revised drawings. Given the amendments above, these proposed drawing corrections should now provide specific support for all the claimed elements and should now be approved. In view of the amendments, and based on the fact that each claim depends from allowed claim 1, the application should now be in *prima facie* condition for allowance.

Claim 4 has been amended to require that the data processing determines a distance of a bottom of said measuring region from a space between a rising and falling edges of a current measured along said line segment. Proposed drawings show in Figure 6a the data processor 10 connected to the ammeter 9, and in Figure 6b a distance "d" between the changes in measured current when the beam is in or outside the contact hole. Page 28, line 4 et seq. of the application states that "Since the region in which the compensation current is not zero corresponds to the region in which the bottom portion of the contact hole is exposed, a width within which silicon is exposed is obtained by measuring the distance. Therefore, the measured distance corresponds to the diameter of the bottom portion of the contact-hole." Based on the substance of page 28, no new matter is added by this amendment to the drawings. Furthermore, claim 4, as amended, eliminates the reference to a "means for obtaining a distance of a bottom..." and should now be in compliance with the requirements of 35 U.S.C. 112, first and second paragraph.

Similar to claim 4, claim 5 has been amended to require that the data processing means determines an area of an unknown measuring region (such as contact hole). Figure 8 shows a graph where the compensation current is proportional to the bottom area of the contact-hole. The application at page 29, lines 9-13 specifically describes the situation where the whole bottom portion of the contact-hole is irradiated with uniform electron beam. The Examiner's attention is also directed to Figures 10a-b and 11a-b, and to the paragraph bridging pages 30 and 31 of the application which discuss utilization of a standard sample in the calculation. A spelling error has also been corrected in claim 5. Claim 5, as amended, eliminates the reference to "area calculation means", and should now be in compliance with the requirements of 35 U.S.C. 112, first and second paragraph.

Claim 6 depends on claim 5. Claim 6 has been amended to eliminate reference to the "area calculation means" and to a "distance calculation means. Claim 6 specifies that the data processing means determines a distance measured from one edge to the other of said unknown measuring region by a division operation. This is

discussed in the application with reference to Figure 9 where it is shown that the compensation current becomes proportional to the square of the bottom diameter. Figure 9 is discussed in the application at page 29, lines 14-19. In addition, the Examiner's attention is directed to the paragraph bridging pages 32 and 33 of the application which discusses obtaining the diameter of the contact hole from the cross-sectional area. Claim 6, as amended, should now be in compliance with the requirements of 35 U.S.C. 112, first and second paragraph.

Claim 7 has been amended to require that the electron beam irradiation means sets the spot size of the electron beam, and that the data processing means calculates a ratio of a value of current produced when a standard sample is irradiated, and calculates an area of the measuring region of the unknown sample. These operations are specifically discussed in the paragraph bridging pages 30 and 31 of the application under the header "Utilization of Standard Sample", and are described in conjunction with Figures 10a and be. As can be seen from the proposed revision to Figure 10a, the dataprocessor 10 is connected to the ammeter 9, and the measurement "d" is shown on Figure 10b. As amended, claim 7 should now be in compliance with 35 U.S.C. 112, first and second paragraph.

Claim 8 has been amended to require that the data processing means determines the value of current produced when a standard sample is irradiated with an electron beam having a known spot size. This is discussed in the application on pages 24-26, and with reference to Figures 1 and 2 of the application. As amended, claim 8 should now be in compliance with 35 U.S.C. 112, first and second paragraph.

Claim 9 has been amended to require that the data processing means compares a current value for a wafer under test with a standard value, and performs the next process based on the comparison. This operation is specifically shown in Figure 13 of the application (see S2 and S4). The operation is discussed in the application on page 34 at lines 18-26. As amended, claim 9 should now be in compliance with 35 U.S.C. 112, first and second paragraph.

Claim 10 and its dependent claims pertain to the secondary electron detector 33 shown in Figures 14a, 15a, 16a, 17a, 18a, 19a, 20a, etc. As explained in the

application, beginning on page 39, lines 22, et seq., and with reference to Figures 14b, 15b, 16b, 17b, 18b, 19b, 20b, etc. The amount of secondary current is compared with the compensation current to provide a picture of the opening which is being scanned by electron beam. In Figure 14b, the scan is the same for the compensation current and the amount of secondary current. This is because the region scanned is cylindrical with vertical side walls. To further highlight this, Figure 14b has been proposed to include the notations α and β which are taken from Figure 14c (i.e., the top and bottom of the opening are equal distance; no new matter is presented by this amendment in view of Figure 14c). In contrast, with reference to Figure 15b, the amount of secondary current has a wider distance than the compensation current. This is because the opening in 41 is tapered outwardly. With reference back to Figures 10b and 11b, it can be seen that the distance d which is measured is the distance at the bottom of the opening, and is not dependent on whether the opening is tapered. In contrast, the use of the secondary electron detector, among other things, allows determining both the bottom distance and the upper distance (specified in claim 11) of the opening, and thereby allow determining the three dimensional character of the opening. This is not dependent on the use of different acceleration voltages as referenced in the office action. Figures 16a, 17a, 18a and 19a show scanning the opening at an angle. These types of measurements provide another level of precision. Note from Figure 16b that the distance for the amount of secondary current is wider than the distance for the compensation current. This is due to the angle of the incidence beam (contrast Figures 14a and 16a). Similar variations are shown in Figures 17a-b, 18a-b, and 19a-b.

Claim10 has been amended to require the secondary electron detector for detecting secondary electron emitted from a surface of a sample under test, and to specify that an amount of secondary electron measured by said secondary electron detector is compared with the result of measurement of said current measuring means by said data processing means. Comparative plots such as those in Figures 14b, 15b, 16b, etc. show the comparison performed by the data processing means. As amended, claim 10 should be in compliance with 35 U.S.C. 112, first and second paragraphs.

Claim 11 has been amended to eliminate a reference to a "correspondingly processing means", and to recite that the data processing means obtains a bottom distance of said measuring region from a distance between a rising and falling edges of current measured along said line segment by said current measuring means and obtains an upper distance of said measuring region from a distance between a rising and falling edges of the secondary electron detected by said secondary electron detector. The upper and bottom distances are discussed in detail above and are shown in the drawings (see e.g., Figures 14b, 15b, 16b, 17b, 18b, etc.) As amended, claim 11 should be in compliance with 35 U.S.C. 112, first and second paragraphs.

Claim 12 has also been amended to eliminate a reference to "correspondingly processing means". Claim 12 requires that the data processing means displays in three dimensions a circular pillar or a frustum of a cone having a bottom distance, an upper distance and a film thickness obtained from the information of the measured bottom distance, upper distance and film thickness of the measuring region as a bottom diameter, an upper diameter and a height. This is shown specifically in Figures 14c and 15c of the application. As amended, claim 12 should be in compliance with the requirements of 35 U.S.C. 112, first paragraph and second paragraph.

Claim 13 has been amended to require a means for tilting the sample stage. Tilting the sample stage is clearly shown in Figures 53 and 54 of the application and the tilting angle is discussed on page 68 of the application at lines 20-24. Reference to the "means for processing a tilting angle" has been eliminated. As amended, claim 13 should be in compliance with the requirements of 35 U.S.C. 112, first paragraph and second paragraph.

Claim 14 has been amended to eliminate the reference to the recording means, the means for comparing, and means for determining. These functions are all performed by the data processing means which stores a current value corresponding to an electron beam irradiating portion obtained in a location of the sample under test having no dust, compares the stored current value with a current value corresponding to an electron beam irradiating position in a pattern portion of an unknown sample

which is the same as a pattern portion of the sample under test, and determines the existence and size of dust from a difference between a rising and falling positions of the current value obtained by the comparison. The application discusses storage in a magnetic disk or memory which will be associated with the data processing means. See particularly, the text on page 44 of the application lines 16 et seq., and Figures 19a to 21b for detecting dust.

Claim 15 has been amended to require that the electron beam irradiation means sets a cross sectional shape of the electron beam such that it covers the whole measuring region in the lump and at least one end of the cross sectional shape is linear, and that the data processing means obtains the bottom distance of the measuring region from a distance between a rising value and a maximum value of current. This is discussed in the application on pages 22-25, (see page 22, line 20, which describes the beam as having a cross section area substantially equal to an are of the aperture). Using the data processing means to obtain a bottom distance (as well as a top distance) is discussed in detail above. The features recited in claim 15 are shown in Figures 1, 2, 3a, and 3b.

Claim 16 has been amended in a manner similar to claim 15, and requires that the electron beam irradiation means sets a cross sectional shape of electron beam such that it covers a whole measuring region in the lump and at least one end of the cross sectional shape becomes linear and said data processing means calculates a differentiated curve of current value with respect to a distance and obtains a radius of a bottom portion of the measuring region from a distance between a rising position and an apex position of the differentiated curve. As noted above, this feature is discussed in connection with Figures 6b, 7b, 8 and 9. It is noted specifically on page 27, lines 14 et seq. that the distance which is obtained can be a diameter or radius of the bottom portion of the contact hole. Claim 16, as amended, should now be in compliance with the requirements of 35 U.S.C. 112, first paragraph and second paragraph.

Claim 17 has been amended to require that the data processing means directs the display of measured current values on a map corresponding to the measured

positions. This is discussed in the application in connection with Figures 35, 37, and 40 (note at the bottom of each figure the output to a display). Claim 17, as amended, should be in compliance with 35 U.S.C. 112, first and second paragraphs.

Claim 18 has been amended to require that the data processing means compares a measured value obtained in one of two regions on a wafer as samples under test with a measured value obtained in the other region as a reference value and extracts positional coordinates when there is a difference equal to or larger than a predetermined constant value. This is discussed in the application with reference to Figures 25-28 (see waveform comparator 123 and defect position memory 126 in Figure 25; see comparison step 28 in Figure 26). The operation of comparing and extracting positional coordinates is discussed on page 51, et seq. of the application. Claim 18, as amended, should be in compliance with 35 U.S.C. 112, first paragraph and second paragraph.

Claim 19 has been amended to remove reference to "comparison means", which was removed from claim 18, and specifies that the data processing means compares current waveforms measured as variations of current values with respect to electron beam irradiating positions in the two regions. In addition, claim 19 specifies that the electron beam irradiation means scans a sample under test with a linear electron beam having length substantially equal to a width of a wiring in a direction perpendicular to a lengthwise direction of the linear line and moves a scan position by a distance equal to the width of the wiring vertically to scanning direction after one line scan is completed. As noted above, a waveform comparator and positional information is discussed in the application in conjunction with Figures 25 and 26. Further, with reference to page 58 of the application, at lines 5 et seq., it is specifically noted that when the electron beam 141 reaches an end of the test region, the irradiation position of the electron beam 141 is shifted by a distance corresponding to the scan interval L in a direction perpendicular to the scanning direction. Claim 19, as amended, should now be in compliance with 35 USC 112, first and second paragraphs.

Claim 20 has been amended in a manner similar to claim 19. Reference is made to page 58 of the application concerning movement after a line scan is completed. See also Figures 30a-b, 31a-b, 32a-b, 33a-b, and 34a-b. Furthermore, page 58 describes detecting a difference of compensation current. Claim 20 as amended should now be in compliance with 35 U.S.C. 112, first and second paragraphs.

Claim 21 has been amended in a manner similar to claims 19 and 20, and should now be in compliance with 35 U.S.C., first and second paragraphs.

Claim 22 requires that the data processing means integrates the waveforms and compares the integrated values. Figure 37 specifically shows pulse integrator 202 and Figure 38 shows integrating the pulse current in S41 before the comparison in step S28. As amended, claim 22 should now be in compliance with 35 U.S.C. 112, first and second paragraph.

Claim 23 requires that the data processing means integrates current from a rising edge to a falling edge of one pulse of a current waveform measured as a variation of a value of current from an electron beam irradiating position, and divides the integrated value by a distance between the rising edge and the falling edge of the pulse and compares current values per unit area of the two regions obtained by the division. See also the text on page 62 of the application concerning the rising edge and falling edge of one pulse. As noted with Claim 22, reference is made to Figures 37 and 38 of the application. As amended, claim 23 should now be in compliance with 35 U.S.C. 112, first and second paragraph.

Claim 24 requires that the data processing means compares positions of a rising edge and a falling edge of the pulse of the current waveform measured as a variation of current value for an electron beam irradiating position. Reference is made to Figures 37 and 38 and the text on page 62 et seq. As amended, claim 24 should now be in compliance with 35 U.S.C. 112, first and second paragraph.

Claim 25 requires that the data processing means compares center positions of a rising edge position and a falling edge position of the pulse of the current waveform measured as a variation of current value for an electron beam irradiating position.

Figure 44 shows comparing the center positions at step S85. As amended, claim 25 should now be in compliance with 35 U.S.C. 112, first and second paragraph.

Claim 26 requires that the electron beam irradiation scans a sample under test by movement relative to an electron beam and conducts sub scans by repeatedly deflecting the beam in a direction different from the main scan direction. The scanning and sub scanning are discussed in conjunction with Figures 45 and 46 of the application (see deflections in Figure 46). The sub scanning operation is discussed in the application at page 66 lines 8 et seq. As amended, claim 25 should now be in compliance with 35 U.S.C. 112, first and second paragraph.

Claim 28 has been amended to require that the means for obtaining information related to the structure in the depth direction obtains a three-dimensional configuration of a through-hole. This operation is discussed in the application at pages 67-70 (see page 67 at line 27 et seq.) and 78, and is shown in Figures 55 to 58 where successive approximation and superposed integration is used. As amended, claim 28 should now be in compliance with 35 U.S.C. 112, first and second paragraph.

Claim 29 requires a means for tilting a sample stage having a sample under test (see above discussion with respect to claim 13). Claim 29 also requires that the data processing means determines whether a diameter of a throughhole is increased or decreased with depth. This is discussed in the application in connection with Figures 53-55. As amended, claim 29 should now be in compliance with 35 U.S.C. 112, first and second paragraph.

Claim 30 has been amended in a manner similar to claim 28 and now requires that the means for obtaining information related to a structure in a depth direction detects a deviation of a circuit pattern in an insulating film from a measured value of current produced by an electron beam passing through the insulating film. Reference should be made to Figures 60-63, 66 and 67 of the patent application, and the description on page 70-75 of the patent application (see "Interlayer Devation" on page 70 at line 8). The claim is focused on, for example, detection of a deviation of a

contact hole position and a lower layer structure. As amended, claim 30 should now be in compliance with 35 U.S.C. 112, first and second paragraphs.

Claim 31 has been amended to require that the data processing means evaluates a deviation of circuit patterns in respective layers from measured values when a penetrating depth of electron beam is changed by changing acceleration voltage. As with claim 30 above, reference should be made to pages 70-75 of the application, as well as Figures 60-63, 66 and 67.

Claim 32 has been amended to require that the data processing means takes in the information related to circuit patterns from CAD data. This is used to obtain a position in which the circuit patterns overlap in the insulating layer. Figure 67 shows the use of CAD data by the data processing means in step S142. Claim 32, as amended, should now be in compliance with 35 U.S.C. 112, first and second paragraphs.

Claim 33 has been amended to require that the data processing means corrects for a current component flowing through a capacitance of a sample under test which is caused by irradiation frequency of electron beam or scanning frequency. This is specifically discussed in conjunction with Figures 69 and 70 of the application (see S165 for extracting the DC component). See also page 76 of the application at lines 13-17. Claim 33, as amended, should now be in compliance with 35 U.S.C. 112, first and second paragraphs.

Claim 34 requires that the electron beam irradiation means has a changeable repetition period for the electron beam and has a construction in which a pulsed electron beam is generated repeatedly. Figure 69 of the application shows in step S163 irradiating repeatedly the electron beam of another repetition frequency. Claim 34 also requires that the data processing means obtains the D.C. component by extrapolation of current value when the sample is continuously irradiated with an electron beam from current values measured by the current measuring means when the sample is irradiated with an electron beam with different repetition period. Figure 69 shows extraction of the D.C. component in step S165. Reference to the means for

changing a repetition has been eliminated. As amended, claim 34 should be in compliance with 35 U.S.C. 112, first and second paragraph.

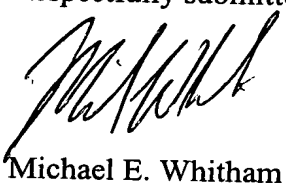
Claim 35 requires that the electron beam irradiation means is capable of switching a scan speed of the electron beam. This is shown in Figure 70 of the application by contrasting the steps S171 and S173. Claim 35 also requires that the data processing means obtains a current value when the scanning speed is extrapolated from the current values measured by said current measuring means when the sample is scanned by an electron beam at different scan speeds. This is shown in Figure 70 of the application at step S175. As amended, claim 35 should be in compliance with 35 U.S.C. 112, first and second paragraph.

In view of the foregoing, it is requested that the application be reconsidered, that claims 1 - 35 be allowed, and that the application be passed to issue.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at 703-787-9400 (fax: 703-787-7557; email: mike@wcc-ip.com) to discuss any other changes deemed necessary in a telephonic or personal interview.

If an extension of time is required for this response to be considered as being timely filed, a conditional petition is hereby made for such extension of time. Please charge any deficiencies in fees and credit any overpayment of fees to Attorney's Deposit Account No. 50-2041.

Respectfully submitted,



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